Wilson Bull., 91(3), 1979, pp. 420–425

TIMING OF PRIMARY MOLT AND EGG-LAYING IN GLAUCOUS-WINGED GULLS

Nicolaas A. M. Verbeek

In a study of the timing of molt in relation to the breeding cycle of Herring Gulls (*Larus argentatus*) and Lesser Black-backed Gulls (*L. fuscus*) on Walney Island (54° 05′ N, 3° 15′ W), Lancashire, England, I found that primary molt began toward the end of the incubation period (Verbeek 1977). Johnston (1961) found that Glaucous Gulls (*L. hyperboreus*) in Alaska began to molt their primaries before or at the time of egg-laying. He suggested that molt in this species overlapped with egg-laying so that both could occur at that time when food was most plentiful. If latitude (i.e. the shortness of the summer and/or photoperiod) is an important factor influencing the timing of molt in gulls, one would expect Glaucous-winged Gulls (*L. glaucescens*) on Mandarte Island (48° 38′ N, 123° 17′ W), Georgia Strait, British Columbia, to time their primary molt and egg-laying similarly as do the Herring Gulls on Walney Island.

METHODS

The colony on Mandarte Island was searched carefully each day during the egg-laying period in 1976 and 1977. When I found a nest containing its first egg, I placed a numbered stake at the nest to avoid recording the same nest twice. If I suspected that an egg was the first in a second clutch, following disturbance of the first clutch, it was recorded but ignored in the analysis.

Adult gulls were caught in chickenwire traps placed over the nest once they contained 1 or more eggs. Each gull was examined for the state of molt of its primaries and a record was kept on which nest it was caught. Each primary was scored from 0 (old feather) to 5 (full-grown new feather), depending on its stage of development. The scoring scheme was as follows: old feather (0), dropped or pin feather (1), brush to ⅓ grown (2), ⅓ to ⅔ grown (3), ⅔ to almost full grown (4), and fully grown new feather (5). The primaries of only 1 wing of each bird were scored; the vestigial 11th primary was ignored. If all primaries of 1 wing were new the total score would be 50. Because the gulls could not be caught in the traps after their eggs had hatched I did not capture any gulls whose primaries were all new. The captured gulls could not be sexed accurately in most cases, thus, data presented here ignore possible differences in initiation of primary molt between the sexes.

RESULTS

First eggs were laid in mid-May (Fig. 1). The mean and median date of laying was 28 May in 1976, and 5 June in 1977. The difference between these means is significant ($t = -2.21$, $P < 0.05$).

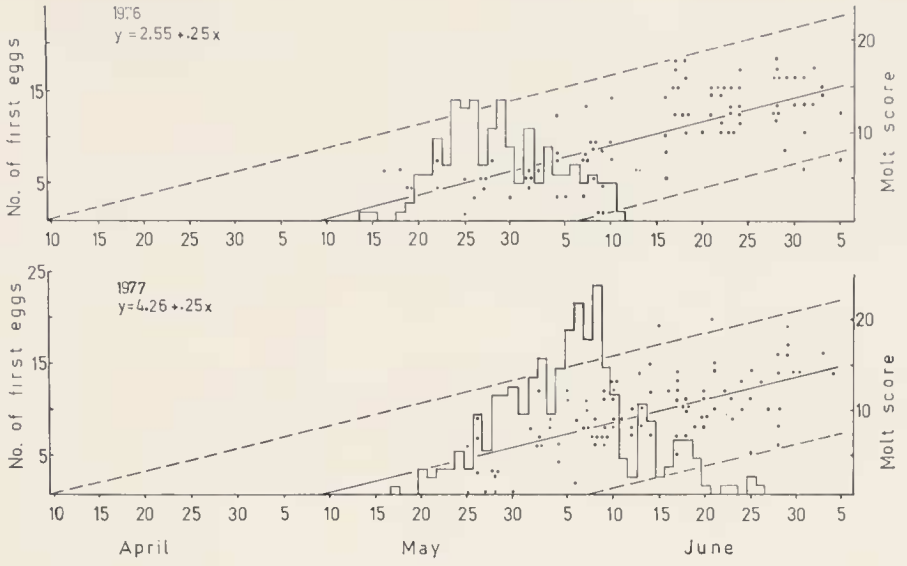

FIG. 1. Molt scores (dots) and the laying date of first eggs (histograms) of *Larus glaucescens* on Mandarte Island. Each dot represents the molt score of 1 bird. The solid, slanted line indicates the progress of molt in time and the regression equations apply to this line. The outer, broken lines represent the approximate temporal limits within which primary molt in the population occurs.

In 1976 only 3 gulls were caught that had not yet begun to molt. The molt scores of 96 birds in 1976 and 98 birds in 1977 indicate that on the average molt in the population began on 9 May in both years (Fig. 1). I estimate that molt in some individuals began as early as 10 April (Fig. 1). On my first arrival on the island on 23 April 1977, shed first (innermost) primaries were found scattered throughout the gullery. Assuming a steady

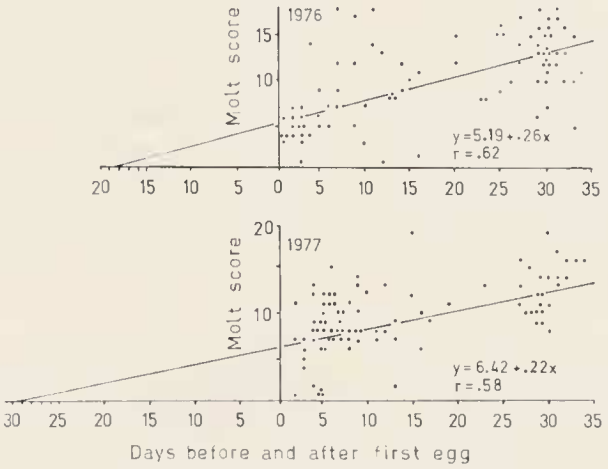

FIG. 2. Molt scores in relation to dates on which each gull scored laid its first egg in 1976 and 1977. Males and females could not be distinguished with certainty. Where the regression lines intercept the x-axis indicates the average day in each year on which molt began prior to egg-laying.

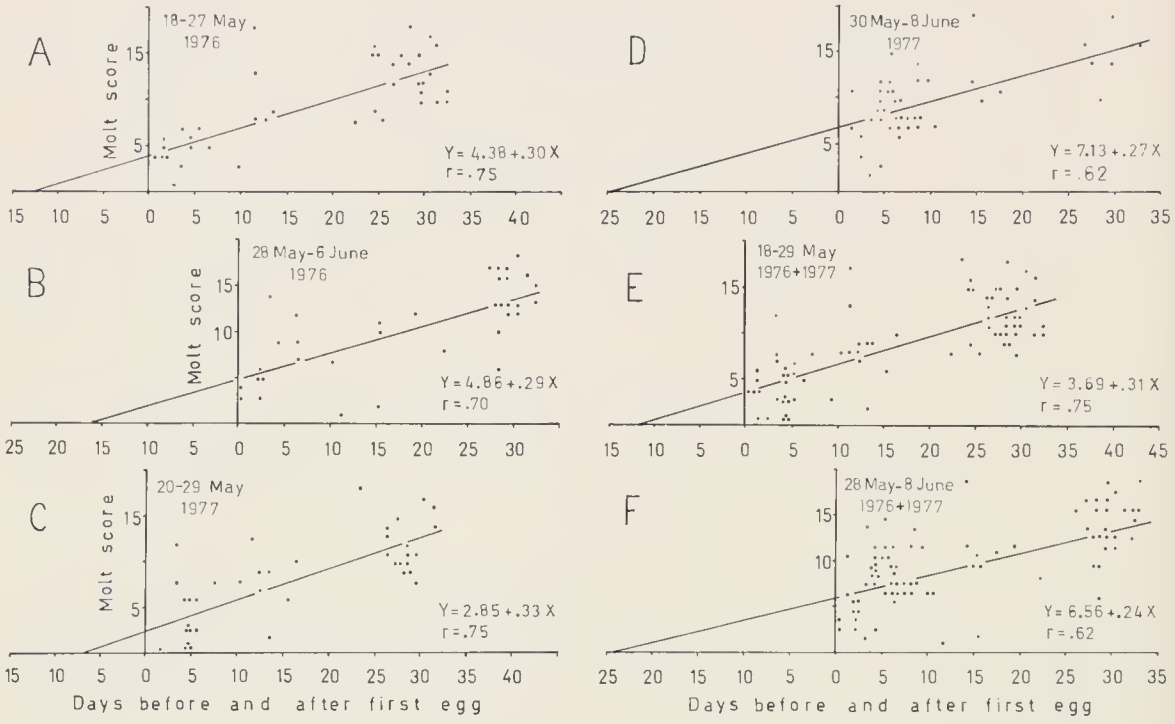

FIG. 3. Molt scores in relation to dates on which each gull scored laid its first egg in 1976 (A and B) and 1977 (C and D). For each year first-egg-dates have been divided into 2 consecutive 10-day-periods. Too few gulls were caught and their molt scored beyond 6 June 1976 and 8 June 1977 to warrant inclusion of a 3rd 10-day-period for each year. Diagram E shows the combined molt scores of A and C, and diagram F shows the combined molt scores of B and D.

rate of feather replacement, primary molt in the population should be completed in 8.5 months, and in the individual in about 6.5 months.

On the average, inception of primary molt in an individual occurred 22 days before the laying of the first egg in 1976, and 34 days in 1977 (Fig. 2). When molt scores of individuals were plotted in relation to when they laid their first egg (presented in 2 consecutive 10-day periods for both years in Fig. 3), it appeared that birds which laid in the first 10-day calendar period did not on the average begin to molt their primaries earlier than birds which began to lay in the following 10-day period (Fig. 3).

DISCUSSION

Glaucous-winged Gulls on Mandarte Island maintain different molt schedules in relation to egg-laying than do Herring Gulls on Walney Island (Verbeek 1977). Both islands have a humid mesothermal climate (Cbf in the Köppen system) and they are located at approximately the same latitude. Mandarte Island is about 400 km farther south than Walney Island, but this cannot explain the differences noted.

Whereas in Herring Gulls on Walney Island egg-laying preceded primary molt, and incubation only barely overlapped with the onset of primary molt (Verbeek 1977), on Mandarte Island the average day of inception of primary molt preceded the mean date of egg-laying by 19 days in 1976 and 27 days in 1977. Although the average day of inception of molt was the same in both years (9 May), the mean date of laying of first eggs was 8 days later in 1977 than in 1976 (Fig. 1). Hence the difference between the 27 days in 1977 and the 19 days in 1976 mentioned above. These same differences in timing between the average day of initiation of molt and egg-laying are shown in Fig. 2 where the molt scores are presented in relation to a common time base. The Glaucous-winged Gull thus resembles the Glaucous Gull in Alaska (Johnston 1961) in which, according to my extrapolation, molt in the population began about 1 May, while egg-laying began on 19 May. Similarly, Glaucous Gulls on Iceland may begin to molt prior to egg-laying (Ingolfsson 1970).

Stresemann (1971) pointed out that in gulls molt and egg-laying are not mutually exclusive. This is confirmed in this study (Figs. 2 and 3). Although the continued cool weather in 1977 produced a significant delay in the mean date of laying of first eggs compared with 1976, the average date of onset of primary molt was the same for both years (Fig. 1). Hence, cool temperatures as such do not appear to affect the onset of primary molt. This suggests that the ultimate factor—day length—exerts control over the beginning of molt in this species.

Herring Gulls (Mayr 1963) and Glaucous-winged Gulls are probably of arctic–subarctic origin. It would be inconsistent to suggest that Glaucous-winged Gulls have maintained their northern molt schedules while Herring Gulls have not. Molt schedules are adapted to local selection pressures and they must fit adaptively in the annual cycle of a species. For instance, with a recent change from migrant to resident status in some Lesser Black-backed Gulls in England, an apparent forward shift has occurred in the timing of primary molt. Resident Lesser Black-backed Gulls appear to molt earlier than migrant individuals (Verbeek 1977). If the Glaucous-winged Gull on Mandarte Island has maintained its arctic molt schedule, the persistence of this schedule must be dictated by local conditions.

The duration of primary molt in the individual Glaucous-winged Gull on Mandarte Island is about 195 days. Similar data for the Glaucous Gull and the Great Black-backed Gull (*L. marinus*) is 205 and 188 days respectively (Ingolfsson 1970). In contrast, Herring Gulls molt their primaries in about 120 days (Harris 1971, Barth 1975, Verbeek 1977). The Glaucous-winged Gull, about equal in size to the Herring Gull, thus requires 75 days longer to molt its primaries than does the Herring Gull.

If the timing of molt and egg-laying, and the duration of molt, is geared to the proximate factor of food availability, and for many birds this seems to be the case (Payne 1972), then it appears that in the population studied here the initiation of molt is geared to a different food supply than the one to which the breeding cycle is geared.

Herring Gulls on Walney Island and Glaucous-winged Gulls on Mandarte Island feed on garbage (Shaffer 1971, Henderson 1972, pers. obs.). This is available all year round and it is not likely to affect the beginning of molt. If it were important, then Herring Gulls on Walney Island should have started to molt earlier than they did. A more likely candidate is fish. To my knowledge little is known about which species of fishes are eaten by Herring Gulls on Walney Island. Early molting on Mandarte Island may be possible because of the early spawning of eulachons (*Thaleichthys pacificus*). Spawning occurs on nearby mainland rivers, such as the Fraser River, from mid-March to mid-May (Andrews 1973). Commercially, most eulachons are caught in March and April (British Columbia Catch Statistics 1969). Glaucous-winged Gulls feed extensively on this species (Hart and McHugh 1944, pers. obs.). The main food fed to the Glaucous-winged Gull chicks on Mandarte Island is Pacific herring (*Clupea pallasii*) (Henderson 1972, Ward 1973, pers. obs.). In the general region of Mandarte Island the mean spawning time of Pacific herring falls in the second half of March (Outram and Haegele 1969). Small fry, 40–50 mm are available in shallow water in June and July. Much of the food fed to the gull chicks consists of these small fishes. Henderson (1972) and Ward (1973) consider the natural food supply available to gulls on Mandarte Island inferior compared to other Glaucous-winged Gull colonies. This may well explain the extended period of molt in this gull on Mandarte Island.

SUMMARY

The timing of the primary molt and egg-laying in the Glaueous-winged Gull was studied on Mandartc Island, British Columbia, in 1976 and 1977. On the average molt in the population began on 9 May in both years, but some individuals began to molt primaries as early as 10 April. On the average primary molt in the individual lasted 6.5 months and began 19 days before the laying of the first egg. Cool weather delayed the mean date of laying in 1977 significantly eompared with 1976, but it did not influenee the mean date of initiation of primary molt. This suggests the importanee of the photoperiod in the timing of molt. Egg-laying began in mid-May and the young were in the nest by mid-June. It is suggestcd that the early start of molt is timed to the spawning of eulachons. The timing of egg-laying is geared to the availability of Pacific herring fry in June and July.

ACKNOWLEDGMENTS

The research was supported by thc National Researeh Council of Canada and a President's Researeh Grant from Simon Fraser University. I wish to thank Joan Morgan for

her cheerful assistance, Jamie Smith for logistic support, and the Tsawaout and Tseylum Indian bands of Saanich, British Columbia, for permission to work on Mandarte Island. The manuscript was typed by Janet Yule.

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DEPARTMENT OF BIOLOGICAL SCIENCES, SIMON FRASER UNIVERSITY, BURNABY, BRITISH COLUMBIA, CANADA V5A 1S6. ACCEPTED 1 SEPT. 1978.